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Computer Science
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Department

Aerial Mobile Gateway for Wireless Sensor Networks utilizing drones

Bachelor Presentation - September 2014

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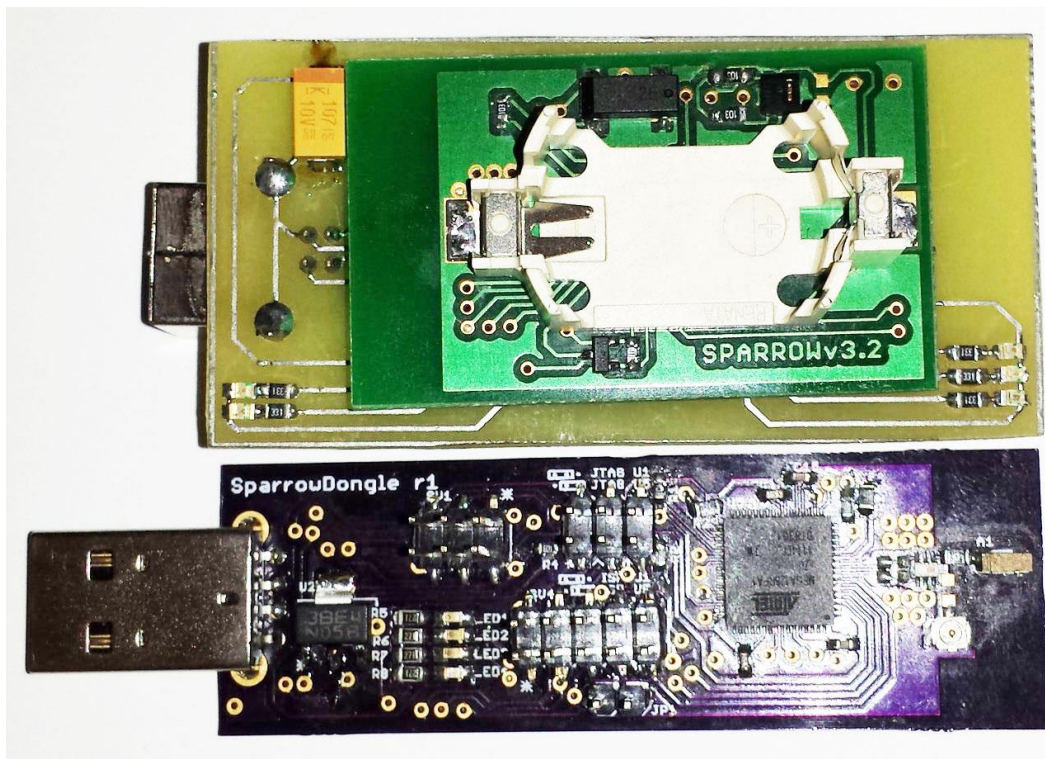


- Wireless Sensor Networks
 - small devices
 - wireless communication
 - gather data from environment
 - long battery life



Sparrow Family

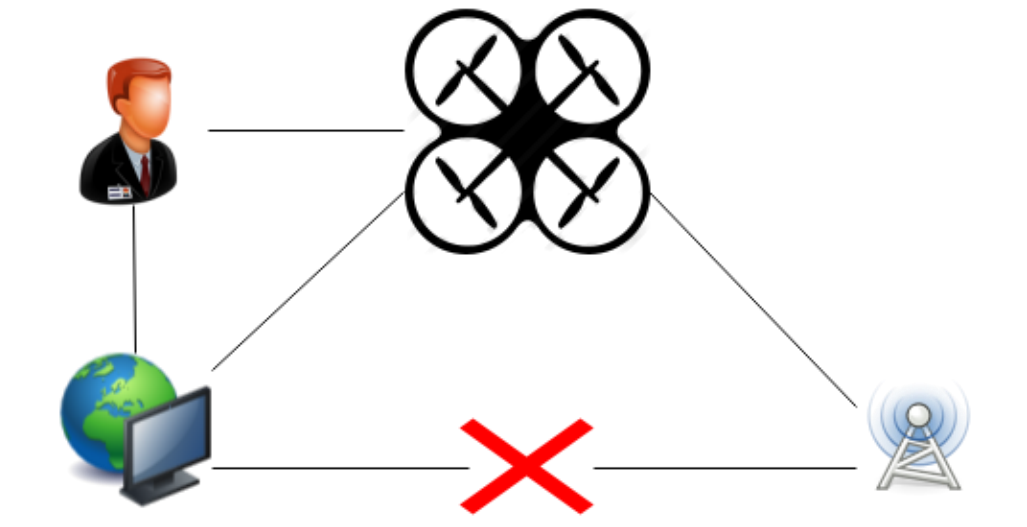
- Atmel ATmega32U4 for USB communication
- Atmel ATmega128RFA1 with 2.4 GHz transceiver





Why?

- Location of the network
- Rapid deployment
- Dynamic environment





Parrot AR.DRONE 2.0

- Linux
- USB 2.0
- Wi-Fi
- 1GHz ARM V8



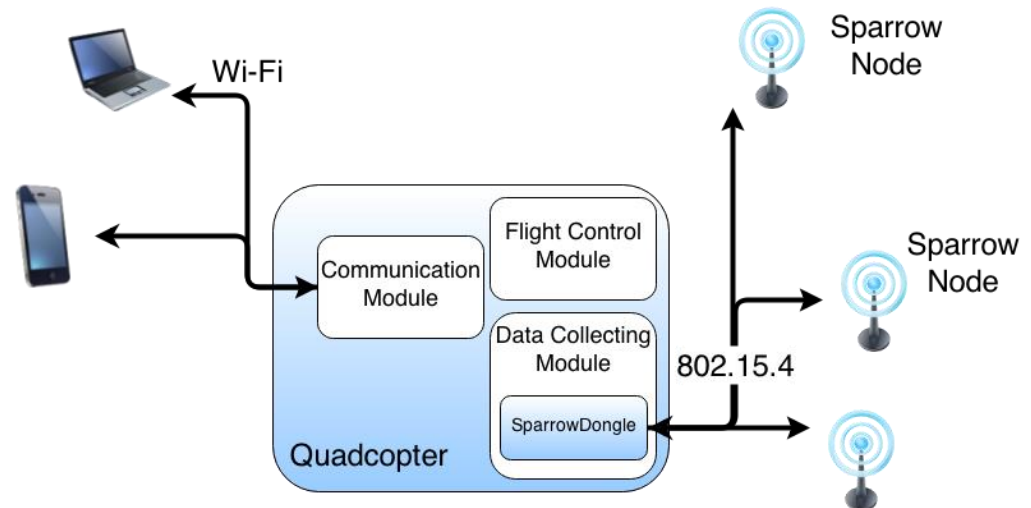


- Ease of interaction
- Proximity function
- Energy Saving
- Latest Data always saved
- Fault Tolerance



System Architecture

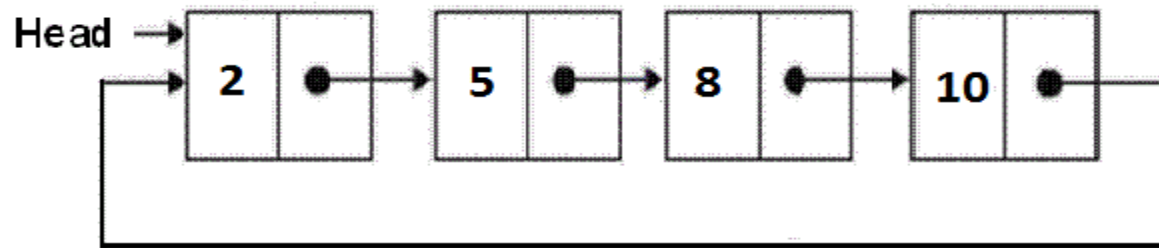
- Sparrow Module
- Data Collecting Module
- Communication Module
- Android Application





Sparrow Module

- Handles node communication
- Saves data in a circular list
- Replaces the oldest data with new data





Data Collecting Module

- Detects the presence of a gateway
- Saves the data received from the gateway into files
- File name composed of timestamp and node id
- Parses the data to obtain node information



Communication Module

- Creates JSON object with the nodes information
- Sends the object through port 8888
- Listens for new connection if current one is lost



Drone Modifications

- Added USB CDC ACM kernel module
- FTP server on port 4242 for data download
- Carved hull
- External antenna mounted
- Counter weight for stability



AR Drone SDK 2.0.1

- Modified Android version of FreeFlight 2.0 from AR Drone SDK 2.0.1
- Added option to locally download data on the phone
- Modified Piloting zone of the application



Piloting Zone

dongle online and 5 nodes connected

- 1. id 106 0.26 sec -30dB
- 2. id 107 0.88 sec -54dB
- 3. id 2 13.12 sec -84dB
- 4. id 9 14.67 sec -87dB
- 5. id 0 7.25 sec -93dB

Node 106

Node 107

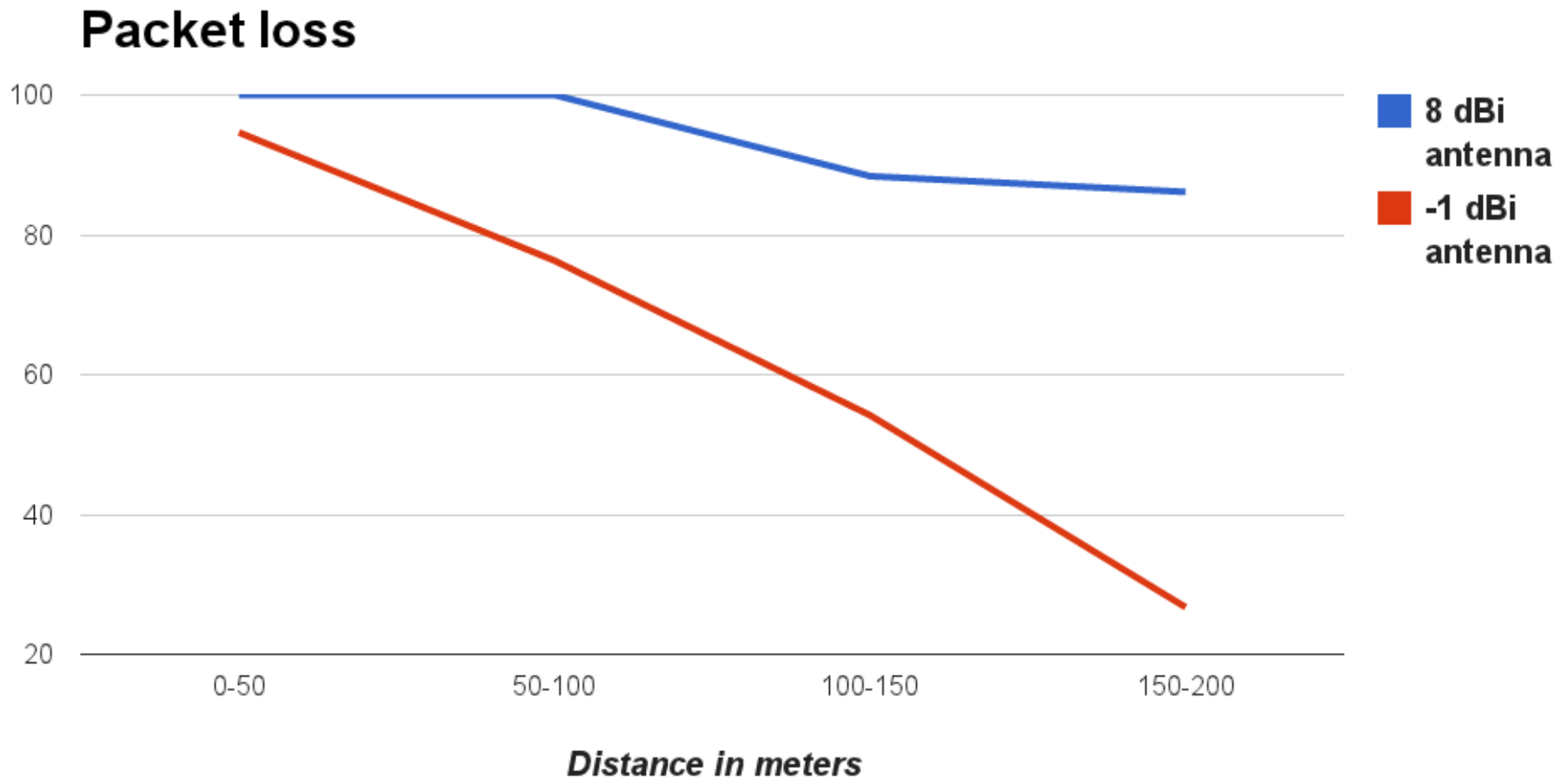
▲ TAKE OFF ▲



- All data saved successfully
- Communication distance - 300 meters with external 8dBi antenna and clear line of sight
- Stability – affected by the modifications
- Packet Loss
 - small for an external 8dBi antenna
 - high for a small -1 dBi SMD antenna



Packet loss





Conclusions

- System is functional – drone successfully deployed in gathering data from remote WSN
- Good transmission distance – up to 300 meters
- A WSN deployed in a wide area can be serviced with a single drone
- This work was presented at the 13th RoEduNet International Conference in Chişinău, Republic of Moldova, September 11-13 2014